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EDITORIAL.

Twelve years ago, when the Library of Congress, at Washington, moved from its old quarters in the Capitol to its new building, work was started on the recataloguing, according to modern ideas, of the enormous number of books and pamphlets which up to then had been classified and listed in a most primitive and complicated system. As a part of this work, which was expected to take about twenty years to complete, cards bearing the cataloguing title of the books were printed and a division of the library established to take charge of the distribution of the cards to any person or institution who would pay a nominal sum for them. The recataloguing is now about 80% completed, and there are available for distribution cards on all books in the Library except those under the classes biography, fine arts, genealogy, language and literature, law, religion, philosophy and music scores. In addition, there are cards on these last-named subjects for those books received into the Library since 1898.

This is a source of bibliographical information unknown to most people. Especially to engineers it is of considerable value, because all the various fields of technology have been covered. In addition to being the legal depository of all books copyrighted in the United States, so that all modern American works must be included on its shelves, the Library of Congress has a generous purchase fund, which is devoted to foreign and ancient books. A catalogue of its collection is a complete bibliography in itself. An engineer wishing a list of books on his specialty or on technology at large could do no better than to procure it from this source.

The cards are in the regular 3 × 5-in. size. Each book or set of books is listed on a separate card which contains the author, title, publisher, date, size, brief resumé of contents and, finally, a list of headings under which subject headings may be made. The price per card ranges from 1 to 3 cts., according to the manner of ordering. Full information as to the scope of the project and the method of ordering cards is given in two pamphlets issued by and procurable from the Library of Congress, the "Handbook of Card Distributors," and "L. C. Printed Cards; How to Order and Use Them."

REVIEWS.

Improving the Mississippi.

Reviewed by MAJOR CASSIUS E. GILLETTE.*

REMAKING THE MISSISSIPPI.—By John Lathrop Mathews. Boston and New York: Houghton, Mifflin Co. Cloth; 5 × 8¼ ins.; pp. 265; 16 plates and 1 text illustration. $1.75.

To gain a clear knowledge of the Mississippi River and its navigation system, one could hardly ask for a more succinct production than this volume. The author has excellent literary skill, is familiar from personal contact with his subject, has undoubtedly given it a great deal of study, and he has the happy faculty of putting really technical discourse into simple language that the reader who is not technically trained can readily understand. Civil engineering is one of the subjects which is shrouded in mystery, largely because its descriptive matter is mostly set forth in language unnecessarily scientific. This book is excellent, not only in its descriptions of the river itself, and its hydrology, but in describing the methods of the engineer in improving it.

On one crucial point, however, the author falls into a technical error, and his deductions are, therefore, misleading on the one great question now being agitated, that of giving the Mississippi a deep channel for navigation. He explains very clearly the three stages of the river: The flood stage, which extends naturally from bluff to bluff, in which the channel, broadly viewed, is comparatively straight; the bank-full stage, in which the channel, within the banks, winds from side to side between the bluffs; and the low-water stage, in which the channel again winds from side to side between the banks.

To improve the river, he would: (1) Eliminate the bluff-to-bluff stage entirely, by confining the river between levees, keeping it, so far as practicable, entirely within the banks. (2) He would make the thread of the current, and, therefore, the channel at low water, coincide with the thread of the current and the channel at high water.

This seems a simple proposition, and, apparently, if done, we would have a continuation of deep water at all stages. He overlooks, however, one vital point. If the river were to stay at its bank-full stage without rising or falling for a long enough period to establish a uniform, gently curving line for its channel, and the bottom were then to harden into, say, concrete, we would have a channel of good alinement when the river fell, but the slope would be so great and the frictional resistance to the water flow so small that the water would run out of the river so fast that there would be comparatively little left for navigation.

But the bottom is soft and movable, and just so soon as the above condition begins to obtain, the low-water ground begins to cut, and it keeps on cutting until its channel is much more crooked and much longer than the channel at the bank-full stage. This works beneficially by holding up the water flow and keeping it for navigation.

It works, however, also in a manner derogatory to navigation, because it first forms a series of long, curved pools, with their curvatures in opposite directions, their ends overlapping, and a long shallow spillway over the bar which goes diagonally across the river between the overlapping ends of each two successive pools. Until the river has selected some point on this bar and deepened it, this "crossing" will be bad. Dredging operations have been mainly confined to accelerating the deepening of these "crossings."

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From the above, it will be seen that the ideal conditions, which are so much to be desired, namely, that of having the thread of the current at all stages of the river occupy the same line, is utterly impossible of fulfillment in a river with alluvial bottom and banks, and this fact puts a limit upon the kind and amount of improvement that can be made at a cost which will make it profitable, and, of course, any improvement which will not pay for itself should not be made.

A board of engineers which has recently reported in great detail upon this subject, has shown how futile are the hopes of ever making at reasonable cost a really deep-water channel in the middle or upper Mississippi.

An important point arises here. The Mississippi was once a naviagable way of colossal importance. Magnificent steamers and enormous fleets of freight boats have used it. Except the coal barges from the Monongahela, they have now mostly disappeared, and yet the navigation of the river is better than it ever was. It is important to determine the reason of this decadence. Mr. Mathews attributes it to our being busy taming a continent and building railroads. This hardly accounts for it, for the Mississippi is large enough to be a very paying proposition if it will make a manifest saving in the total transportation costs of the enormous quantities of freight originating in its basin. The real reason of its decadence appears to be the following:

Railroads have developed and been improved until their carrying costs have reached a very low figure. The trunk lines have their small railroad feeders, and the managers of the trunk lines have seen to the providing of such feeders.

Feeders to the river must also be branch railroads, as navigable rivers can not be carried into corn fields. No one has looked out for the building of these feeders. There is no general manager of the Mississippi to see that they are built. The general managers have all been working for the railroads.

These facts have something to do with the decadence of traffic, but the great reason appears to be the cost of handling freights from cars to boats. A grain elevator alongside of a deep dock can make such transfer quite cheaply, but a grain elevator alongside of the Mississippi River, which fluctuates thirty or forty feet in height while its shore line is advancing or receding up the sloping wharves by one or two hundred feet, served with boats which must be very wide in order to carry paying cargoes, is a wholly different proposition, and no cheap plan of making such transfer has been devised. These costs form so large a percentage of the total transportation costs, that the grain once loaded in the cars has been hauled direct to the Atlantic Seaboard rather than to the Mississippi River boats, and there have become limited to the gathering of such cargoes as grow on the immediate banks of the river. The coal navigation has persisted largely because it goes from the mines along the Monongahela into the barges direct.

The fact that the principal grain and cotton shipments have been to the eastward has also been of importance, because a cargo of wheat for Europe from St. Louis if sent by the river would have to be first put on the cars, hauled to the river, transferred to the boats, sent to New Orleans, transferred to a ship and carried to the Florida straits before it would be as near Europe as it would be at New York or Baltimore, where it could be hauled in the cars without any rehandling.

Another advantage railroad shipments have had over river shipments is in the matter of in-

surance. A cargo is more safe loaded on a train than it is if sent down the river in one of the fragile, flat-bottom boats, subject to the snags and other dangers of its muddy current.

That decay of traffic on the Mississippi is not due to lack of capacity in the navigable channel, is shown by the fact that the Mississippi Valley Transportation Co., before it went out of business, sometimes carried at one shipment eight grain barges, each holding 1,000 tons. Larger cargoes, at this date, would hardly be shipped if the river were made deep enough for the largest ocean vessels.

With the opening of the Panama Canal, New Orleans will become the shipping point for large quantities of freight from the Mississippi Valley to the Pacific region, and the river should naturally become the route for a part, at least, of the bulky freights, if the difficulties of gathering up and rehandling grain can be removed. A moderate increase in the depth is feasible, together with the prompt removal of temporary obstructions. Beyond this, the energies of those who wish the navigation developed should be in the line of development of feeders to the river. These must generally be railroads, but small canals might possibly be used, although there will always be difficulty in connecting a canal with a river that fluctuates in height so much as the Mississippi; but the cost of such work should not be prohibitive.

In its historical matter, the book falls into errors so often reiterated that they have almost become classical. This refers to the opening of the mouth by the Eads jetties. Running through all these descriptions, is the underlying thought that the Corps of Engineers had simply been stiff-necked obstacles, opposed to real progress, and opposed to new ideas from "outsiders." This is entirely erroneous, but the author is only following out a popular line when he takes a jab at officialdom and makes a point of assumed technical value in the fact that James B. Eads had difficulty in buying books when he was a boy.

As a matter of fact, the officers of the Engineer Corps in the Army have just as diverse views and just as much individual independence as competent engineers anywhere. Jetties were well known and their principles well understood by others than Eads. There was a difference in judgment as to their probable success at the mouth of the Mississippi, and there was opposition to the plan of having Congress make a direct contract with an individual. There is a pretty well-fixed opinion now in the minds of engineer officers that if Congress desires to get the benefit of any individual's special qualification, the proper way is to employ him. For a legislative body to make contracts, has always proven a bad policy. Prices are not determined competitively, and influence counts for altogether too much.

Even in the case of Eads and the jetties, this objection appeared. He made a contract definitely agreeing to do definite things. He failed, and then went before Congress and got the contract modified to fit what he found he could do. Eads was a great and able man, but his talents apparently lay much more in his ability to convince Congressmen than as a technical engineer. In this, his abilities were strikingly like those of De Lesseps, another man famous as an engineer but really a promoter. Eads had a very competent contracting firm to build his jetties, and he had very competent assistants, like Mr. E. L. Corthell.

As to the location of the Eads jetties and of those now being constructed, it is quite probable that neither the South Pass, which Eads improved, nor the Southwest Pass, which is now being improved, is the best for the future welfare of the entrance.

An examination of the charts from Columbus, Miss., to the mouths of the river, shows two striking features. The river has built the entire delta region between these two points, but instead of progressing straight south into the gulf, or occasionally going to the west, it has constantly shifted to the eastward at a very considerable angle.

Another striking fact is that the land built up all along the delta part of the river is always more than twice as wide on the west as it is on the east.

Apparently, these facts can only be accounted for in one way. The vast quantities of mud and other material brought down by the river, are, on striking the gulf, gently drifted to the westward, probably by a slow eddy current off the gulf stream. These, when deposited, fill up the gulf to the west much more than to the east. For these reasons, those branches of the delta going to the westward gradually come to empty into a very shallow sea, with the result that they are ultimately closed up by storms, etc., and only the easterly mouths remain open.

It may be a long distance in the future, but it looks as though the time would undoubtedly come when both the South Pass and the Southwest Pass will have to fight for their existence, and it will be a losing fight unless the jetties are extended to some very unusual lengths. It would have been fighting with nature instead of against nature to have put our improvements on one of the easterly mouths, even though at present they are in rather poor condition.

There are some minor errors in the book. For example, the statement is made that the Engineer Corps of the Army has no post-graduate school following West Point. There is, however, a very thorough school, formerly at Willett's Point, N. Y., now at Washington Barracks, D. C.

The author makes a point that tributaries to the Mississippi system, far removed from each other, have not been improved to fit the same size of boats. This is an unimportant matter, as it is hardly probable that any boats would ever want to navigate down one tributary from the head of navigation and up another to a similar point. They will generally run from the head of navigation to some distributing city and back again, so that the variety in development is not really of much importance.

TRANSPORTATION BY WATER IN THE UNITED STATES.—Report of the Commissioner of Corporations. Part I.: General Conditions of Transportation by water. July 12, 1909. Pub. Doc. Paper; 5⅝ × 9¼ ins.; pp. 614; 1 folding map and 27 tables. Part II.: Water-borne Traffic. July 19, 1909. Pub. Doc. Paper; 5⅝ × 9¼ ins.; pp. 402; 5 maps and 309 tables. (Herbert Knox Smith, Commissioner, Washington, D. C.)

Following the initiation of President Roosevelt's water-improvement campaign of 1907-08, there were three bureaus or commissions started on the work of investigating the conditions and possibilities of the waterways of this country, the National Conservation Commission, the Internal Waterways Commission and the Bureau of Corporations of the Department of Commerce and Labor. The first of these three took up waterways only as a subordinate subject, but its report contains considerable that is of value. The second contented itself in its first report, recently issued, with the problems and possibilities of the future and devoted but little attention to the conditions of the past and the present. This latter is the especial study of the last of the above-named bureaus, and is the subject of a series of reports the first and second of which are noted in the headpiece above.

The title of this Part I. is "General Conditions of Transportation by Water," and the subjects with which it deals are recorded as:

(1) The natural and artificial coastwise and inland waterways, and the character and results of the more important improvements thereof.
(2) Vessel equipment types, number and tonnage.
(3) Vessel ownership, business organization, and finances of navigation lines and companies, in regular lines, bulk carriers, and towing concerns.
(4) Contracts for the carriage of goods, shipping documents, the liability of carriers and statutes relating thereto.
(5) Marine insurance and its general influence on water transportation.
(6) Taxation of vessels and of navigation companies.

As may be expected from these headings, the report deals largely with matters of a statistical nature or else, as the preface says, "conditions familiar to those in the business though not hitherto presented to the public in complete form." Nevertheless, it contains much information not generally known by engineers who are conducting the improvements of rivers or by the enthusiasts who are exploiting and promoting such improvements. In view of the somewhat haphazard statements and claims of some of these latter gentlemen, we would say that this compilation is distinctly worth while as furnishing an authority for a basis of waterway study.

Part II. is devoted to a record and tabulation of the statistics of water-borne traffic. For convenience the country has been divided into six sections, viz., North Atlantic, South Atlantic, Gulf of Mexico, Great Lakes, Mississippi River and tributaries and the Pacific Coast, and the statistics on each section classified together, with special reference to the more important ports and rivers in each section. Most of the information has been compiled from already published sources, but the gathering together in one place is the peculiar value of this volume.

The exact nature of the future reports of the Bureau is not entirely clear, but it is to be supposed that it will be a more involved study of the problem based on the information presented in Parts I. and II.

Robert Fulton—Inventor.

ROBERT FULTON AND THE "CLERMONT."—The Authoritative Story of Robert Fulton's Early Experiments, Persistent Efforts, and Historic Achievements. Containing many of Fulton's hitherto unpublished letters, drawings, and pictures. By Alice Crary Sutcliffe, Great-granddaughter of the Inventor. New York: The Century Co. Cloth; 5 × 7¾ ins.; pp. 367; 30 plates, and one folding sheet. $1.20, net.

This timely and interesting book is not a complete biography of the celebrated inventor. It cannot be called a narrative of his life but rather presents glimpses of the man, his friends and the scenes in which they moved. All this is shown mostly in connection with the development of his many and varied projects. The author of these notes, Fulton's great-granddaughter, seems to have had access to family papers and relics which have escaped scrutiny in the past. New material for such a book seems to have been slowly brought to light, both in this country and abroad. As a result, there is here collected possibly more of Fulton's own comments on his ideas and ambitions than has ever before been seen in print.

The author writes with a pleasant touch of enthusiasm and evident pride in the work of her ancestor. Her arrangement of fact, legend and anecdote evidently have been made to show him, first of all, at heart a warm patriot and a promoter of international peace. His activities group themselves into four classes. First, of course, are his earlier years as a painter; then one reviews his unsuccessful attempts to have three governments adopt submarine methods of warfare with his war engines—the torpedo and plunging boat. Thirdly, comes his interest in canals for irrigation and transportation, and, last, but most important of all, his partnership with Chancellor Livingston and the successful development of the several schemes then afloat for steam navigation.

The book starts off like a real biography with the usual fragmentary story of his childhood and with something about his ancestors. The probable environment which are supposed to have influenced his mental tendencies are described—the home in Lancaster; the farm in Little Britain; the friendships with the family of Benjamin West, afterward a celebrated painter; the local stirring events of the American Revolution. From such a start something new is expected about his last days and one is disappointed to find these notes ending practically on the prestige brought by the success of the "Clermont" and the later boats.

There are also a few points on which a student of early engineering progress in this country will look in vain for new light. The controversies over the validity of Fulton's patents, the contentions that he appropriated other's ideas, the real nature of the Livingston-Fulton steamboat monopoly, and the delicate questions of how it was secured, are perhaps most important and interesting.

The volume shows some signs of hasty preparation, probably passed over in the endeavor to place the book on sale just before the present elaborate centennial celebration. On page 255,

an absolutely disconnected extract from Renwick's "Life of Robert Fulton," on the inventor's "charm of personality," is slipped in between items on the management of the "Clermont" as a packet boat. Fulton's desire to work out a steam railway is set forth, on page 265 and following, between a letter on laying up the "Clermont" for winter and a section on its enlargement into the "North River."

The book contains many evidences of Fulton's skill as a portrait painter—reproductions of several miniatures and larger portraits which have never been published before. His skill as a draftsman is disclosed in the drawings and sketch designs of his early boats. It is unfortunate from the engineer-reader's point of view that the size of these pages has prevented reproducing some of these designs to a scale large enough to make clear the important details. The selected extracts and reproductions from Fulton's note books, which evidently were carefully preserved by his daughter, intimate, rather than disclose, the care with which preliminary experiments and studies were made. The results were embodied in designs of boats to fulfill certain requirements and the records show that the performances, in the end, satisfied or even surpassed the designs. Knowing the state of engine design and of marine architecture a hundred years ago, this alone appears to be a real triumph and a distinct feat about which we cannot have too much knowledge.

Railway Block Signalling and Power Interlocking.

Reviewed by H. G. PROUT,* M. Am. Soc. C. E.

POWER RAILWAY SIGNALLING.—By H. Raynar Wilson, Author of "Mechanical Railway Signalling." No. 5, The Railway Series of Text Books and Manuals by Railway Men for Railway Men and Others. London, England: The Publishers of the "Railway Engineer." Cloth; 9½ x 12 ins.; pp. 342; 623 illustrations in the text. 18s.; American price, $7.20.

Mr. Raynor Wilson published some time ago a book entitled Mechanical Railway Signalling, and the title of this latest work has been chosen somewhat in reference to the earlier one. This title, while perhaps sufficiently descriptive for a title, does not give an adequate notion of the scope of the work, which, in fact, deals with practically everything in block signalling as well as in power interlocking. Obviously, a field so vast can only be covered quite superficially in one volume of 340 pages. Nevertheless, the information collected will be of interest to the student and of use to the operating man, the engineer and the designer.

The first chapter, on instruments, describes the block instruments in familiar use in England, as, for instance, the single-needle instrument, Tyer's one-wire instrument, Tyer's three-wire instrument, the London & North Western block instrument, Preece's system, and so on through the varieties of bell and block instruments in familiar use in England. It describes very briefly American practice in telegraphic blocking, and gives some detail of various indicators, repeaters, train describers, and the like.

Three chapters are devoted to lock-and-block instruments and systems, and another chapter to contact makers (track instruments), slots, replacers, detectors and insulated joints. A short chapter is given to the protection of drawbridges, then follow three chapters on the electric train staff and on the tablet system.

Something like one-third of the volume is thus occupied with details which would hardly be brought to mind by the title of the work, but with the eleventh chapter Mr. Wilson takes up automatic signalling. He describes at some length the various systems and the apparatus that we are familiar with in America, and he gives also accounts of automatic signalling in Great Britain and on the continent, where it has not been carried nearly so far as in our country. This section closes with chapters on signalling for electric tram roads and on electric cab signalling and automatic train control.

Finally, six chapters are given to power interlockings. These describe the electro-pneumatic, the low-pressure pneumatic and the electric systems now so well known, and also the electro-mechanical plants at St. Enoch's Station, Glasgow, and Victoria Station, London, while a short chapter is given to hydraulic power plants.

Having made this hasty general statement of the scheme of the book, we may now turn back and consider its various divisions in a little more detail.

Block signalling is an old art in England, and the block instruments described in the first chapter are ingenious, varied, well developed, and, for English conditions, useful. They enable the signalmen to exchange sufficient information for their purposes without knowledge of telegraphy, by simple bell codes and by visible indicators. With the good discipline of British railroad men they get on well without electrical control of the actual operation of the signal at one end of the block by an operator at the other end. In other words, they contrive to protect a dense and vast traffic without the use of controlled manual or lock-and-block systems and without track circuits. The conditions in England are such that plenty of men can be employed in signalling, and the high discipline and the old-fashioned sense of duty prevailing amongst these men makes the life of the operating officer a good deal simpler than it can be here. It is, perhaps, hardly necessary to say that the principal reasons why it is practicable in England to use more signalmen per mile of road than we can use here are that wages are lower and that junction points and turnouts are much more numerous, requiring the frequent presence of men to work interlocked switches. The obvious thing is to use these men as signalmen.

In Mr. Wilson's second chapter he takes up lock-and-block systems, of which he says eight are in use in Great Britain. He does not, however, give us any notion of the extent to which these systems are used. The Block Signal and Train Control Board of the Interstate Commerce Commission, however, tell us that "practically all of the English roads use the manual block system"; the controlled manual being used only "to some extent." Without seeking further to get accurate statistics in this matter, it is probable that the language used by the block-signal board gives us a sufficiently definite and accurate idea of the situation.

Mr. Raynor Wilson accounts for the little progress made of recent years in lock-and-block operation in England and for the silence of the Board of Trade inspectors in this matter by saying that the lock-and-block method "cannot be regarded as perfect." However that may be, the matter is not at the moment of acute interest to very many of us in the United States, where the lock-and-block system is giving way to automatic signals.

The chapter on "Contact Makers, Slots, etc.," describes a dozen different track instruments for making and breaking contacts, and nine slots, or "replacers" as they are called in England. It is obvious that this chapter might be suggestive to the designer. The same thing may be said of the chapter on "Interlocking Opening Bridges," in which mention is made of ten different bridges in England and in the United States. Here, as is often the case throughout the book, the chief value is in suggestion, as the descriptions are not thorough enough to give much useful detailed information.

The four chapters on "Working Single Lines" may, perhaps, be as interesting to the American reader as any part of the book; British methods are so different from our methods that it is at least interesting to know about them, even if we do not think that we can learn any useful lessons from them. But it is quite a mistake to suppose that British experience in single-track working is so limited that we may ignore it. The latest edition of the "Statesman's Year Book" shows that on Jan. 1, 1908, the total miles of railway in the United Kingdom were 23,108, and of this total, 10,263 miles were single track. In the United States, to be sure, we have about ten times as many miles of railroad and about twenty times as many miles of single track, but the British mileage is enough to give a pretty respectable experience, particularly when we remember the density of the traffic. Furthermore, the Englishman has had a good deal of single-track experience in his Colonial possessions and in the excursions that he is constantly making into the countries of other people, whose railroads he frequently builds and operates.

Mr. Wilson says that in Great Britain single-track working has reached such safety, "freedom and expedition" that "the conversion of a single into a double line is now a rare event." Very possibly there are other reasons which are more powerful, but at any rate we all know that single-track working in the United Kingdom is immensely safer than in the United States, and that it is reasonably satisfactory to the operating officers and to the public served.

Our own people prefer the train dispatcher and the train-order system to anything that is used abroad, and perhaps they are right. At any rate, they have been able to do a colossal business, over a vast area, and to give rates and service unapproached in any other great nation; and while the train dispatcher has been only one element out of many in developing our splendid railroad system, so also, he has been one element out of many in giving us a bad reputation for railroad accidents. However this may all be, the American signal engineer and operating officer will find considerable interest in reading Mr. Wilson's four chapters on train staffs, tablets, tokens and the various means of controlling hand-operated signals. The reviewer does not find that he tells us anything new, but he has summed up a great deal of information.

The four chapters on automatic signalling will probably be of as little interest to the American readers as any in the book, for Great Britain and the continent of Europe are far behind us in this field of the signalling art, and Mr. Wilson has presented practically nothing which has not already been brought to the attention of American readers in various ways. He mentions a dozen small installations of automatics in Great Britain and a few on the continent, all of which may be regarded as almost experimental, although there are two or three pretty robust installations in England, particularly on the underground roads. Of the use of automatics on the continent, Mr. Weissenbruch, of the Belgian State Railways, says that the mangement has concluded that automatic signals on the lines of the Belgian State Railways are not justifiable on economic grounds. On 2,500 miles of railway there are 1,200 stations and junctions and 3,300 protected level crossings; consequently, the lines may always be divided into sections such that the signals may be worked by employees who must be present for other duties. Furthermore, in Belgium, there is ample cheap labor, of a comparatively ignorant class, while skilled electricians are scarce; and in Belgium automatic signals are not thought to be any safer than hand-operated signals. This is a pretty good summing up of conditions and opinions on the other side of the Atlantic. In America, as we know, the sentiment is quite different. According to Poor's Manual there were in this country at the beginning of this year 232,045 miles of railroad. Of this mileage, according to the Interstate Commerce Commission, 12,191 miles, or 5.2%, are protected by automatic signals; 47,358 miles, or 20.4%, by manual signals. Relatively, it will be seen that automatic protection, even in this country, is small, but absolutely it is great, probably sixty times as much, as all of the automatic territory in the rest of the world.

A chapter of moderate interest is a very short one on locomotive-cab signals and automatic train control. Mr. Wilson says "The number of arrangements for repeating fixed signals in the cab of a locomotive that have been patented is legion." Nevertheless, he is not able to give us any instances of cab signals or train control of any importance whatever. In our own country we have gone far beyond Europe in the use of automatic stops, and probably are quite as far along as Europe in the use of cab signals, which is saying very little.

An important part of Mr. Wilson's book, namely, 100 pages out of 340, is given up to power-interlocking plants. Here are described the electro-pneumatic, the electric, the low-pressure pneumatic, the electro-mechanical and the hydraulic systems, mention being made of numer-

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ous different sorts of interlockings and of many individual installations. Here, too, it is probable that most which is told is quite well known to American readers, if it is of real importance, as we were earlier in the field with power interlockings than anyone else and have made much wider use of them. Nevertheless, the collecting into small compass for convenient reference of the various different systems will be a matter of considerable convenience to many readers.

In summing up it may not be amiss to say that Mr. Wilson's book is a useful one and is quite unique, the literature of signalling and interlocking being still very small compared with the importance of the art. On the other hand, it is only fair to the reader to say that he will be constantly disappointed, as he goes through this book, by the lack of thorough and finished description. In a great degree this is perhaps inevitable in an effort to cover so varied and broad a subject within the compass of one moderate volume. Nevertheless, the reader will oftener than not find that he is started on a subject concerning which he must go elsewhere if he desires anything like complete information.

Clerk's The Gas Engine Revised.

Reviewed by LIONEL S. MARKS,* M. Am. Soc. M. E.

THE GAS PETROL, AND OIL ENGINE.—Vol. I., Thermodynamics of the Gas, Petrol and Oil Engine, together with Historical Sketch. New and revised edition. By Dugald Clerk, F. R. S., M. Inst. C. E. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 380; 5 plates and 121 text illustrations. $4, net.

Mr. Dugald Clerk occupies a unique position in gas-engine work among English-speaking engineers. He has made the gas-engine field his own by reason of his investigations, his inventions and his publications. If the name "authority" may be used in respect to any one in engeering work it should be applied to him in this special field. His investigations include the earliest work on explosive mixtures that is of practical value to the engineer, the earliest theoretical investigations of gas-engine cycles, and the latest work on the cooling action in gas-engine cylinders and the properties of the expanding gases. His inventions include the two-cycle engine now, at last, come into common use, but actually built and operated by him thirty years ago. His publications include numerous papers and the book of which the volume before the reviewer may be regarded as the third edition. It is consequently a matter of much interest to see what Mr. Clerk has to offer; it is sure to merit the respectful attention of all engineers interested in the practical or the scientific development of the gas engine.

The first edition, published in 1886 under the title of "The Gas Engine," was, in effect, the first book on that subject. The second edition, published in 1896, was an entirely different book, several times larger than the first book. In the 13 years since that edition the gas-engine field has widened enormously and an entire rewriting has again become necessary. The present work is in two volumes of which the first only is, as yet, published; it is entitled "Thermodynamics of the Gas, Petrol and Oil Engine." The second volume will be entitled "The Gas, Petrol and Oil Engine in Practice."

The present volume opens with an historical sketch enlarged considerably from the original work. Chapters I. and II. deal with the gas-engine method and the classification of gas engines. Chapter III., on Thermodynamics, deals with the theoretic efficiencies of a large number of gas-engine cycles, under the preliminary assumption that the working substance is air and of constant specific heat. The causes of loss in gas engines are then classified under eight heads and are discussed in a general way. In the chapter on Combustion and Explosion the principal matters considered are true explosive mixtures, inflammability, rate of flame propagation, variable specific heats and dissociation.

The contents of the book up to this point show little change (other than considerable additions which bring the information up to date) from the previous edition. The principal part of what the writer has to say is contained in the last four chapters, which occupy nearly two-thirds of the book. The expansion and cooling of an exploded charge in a closed vessel take up three of these chapters. First there comes a detailed description of the important experimental investigations on explosions of gaseous mixtures in vessels of constant volume. The methods and results are given for Clerk's own work both of 1884 and 1900, and the work of Grover, of the Institute of Technology, of Petravel, of Bairstow and Alexander and of Hopkinson. A critical comparative study of these investigations permits the determination of the rate of cooling of the explosive charge, and of the influence on that rate of the size of the vessel, of the original pressure or density of the charge, and of other factors. Useful constants are obtained and deductions made as to the influence of these various factors in gas-engine economy. In particular it is shown that the cooling loss (heat loss to the walls during explosion and expansion) is less than has generally been supposed in engines of moderate size, and is practically negligible in very large engines. It is consequently demonstrated that there is very little to be gained by realizing the favorite inventor's dream of a non-conducting or incandescent wall to the cylinder.

The conditions in a closed vessel of invariable volume differ, however, in many respects from those obtaining in a gas-engine cylinder with a moving piston. The only careful investigations that have been made of the phenomena of cooling in an actual working cylinder are the elaborate investigations by the author, part of which were described a short time ago before the Royal Society of London and part of which are presented here for the first time. In these investigations the admission and exhaust valves of a gas engine which is functioning under normal conditions of operation, are closed, and kept closed for a number of revolutions of the engine. The exploded charge consequently expands and is compressed alternately. A comparison of the expansion and compression curves, as traced by an indicator, permits important deductions as to the rate of cooling of the exploded charge and as to the apparent specific heat of the charge at different temperatures. These matters are gone into very fully and constants are deduced. In general it is found that the heat loss to the walls is most rapid at the beginning of the expansion stroke, notwithstanding the smaller surface exposed, and that usually one-half of the heat is given up by the time the piston has reached three-tenths of its stroke. A table is given of both mean and instantaneous apparent specific heats, of which the author makes use later in his discussion of the thermal efficiency of actual engines. The apparent specific heat differs from true specific heat since it takes into account such dissociation and incomplete combustion as may take place in an engine operating under normal conditions.

The final chapter on "the thermal and mechanical efficiency of the different types of gas engine in use" is devoted mainly to a discussion of the results of tests of four-cycle engines. It includes long quotations from the reports of the Research Committees of the Institution of Civil and Mechanical Engineers, and from papers by Hopkinson and others. The author applies to the results of the reported tests his own method of determining heat balances from the indicator cards, using the values of apparent specific heats just referred to. The difference between the heat given to the jacket as found by this method and as found by the usual method is the heat given up to the walls by the exhaust gases while the exhaust valve is open. Ideal efficiencies calculated by the use of the author's apparent specific heats gives values to which real engines approximate much more closely than to the air-engine ideal efficiencies. Modern engines show an actual thermodynamic efficiency which is about 88 per cent. of the ideal efficiency as calculated by Clerk's method; their efficiency compared with the air standard is only about 71 per cent.

The appendix includes the whole of the very valuable report of the Gaseous Explosions Committee of the British Association.

This book is a valuable contribution to the thermodynamics of the gas engine. It presents for the first time an adequate treatment of the phenomena of heat interchange between the gases and the cylinder walls; accounts for the "lost heat"; and gives a method and constants which should be of the greatest value in the analysis of gas engine performance. The experimental work, which is reviewed and discussed, is, perhaps, too exclusively the English work. Some very valuable recent German work has apparently escaped the notice of the author, notably the work of Nägel on gaseous explosions and on gas engines, and that of Bunte on explosive mixtures. In the discussion of dissociation in Chapter V., Deville's work is considered, but that of Nernst is not spoken of. Similarly the work of Berthelot and Vieille on the explosive wave is described at some length, while no reference is made to Dixon's later and better work. These, however, are but minor omissions and do not affect in any way the main general results at which the author aims consistently and on which the value of the book depends.

*Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

Gear-Cutting Machines and Practice.

GEAR-CUTTING MACHINERY.—Comprising a Complete Review of Contemporary American and European Practice, Together with a Logical Classification and Explanation of the Principles Involved. By Ralph E. Flanders, Associate Editor of "Machinery," Author of "Bevel Gearing." New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ × 8¼ ins.; pp. 319; 219 illustrations in the text. $3; English price, 12s. 6d., net.

When one thinks of all the machinery in which accurately formed gears have a place, the preparation of a book covering, as the author states, "the whole field of gear-cutting, illustrating so far as possible, every machine and process which has come into commercial use," seems to be an enormous task. Before examining this book one may be forgiven for wondering if its utility is worth such great labor. A study of the book shows that the author has carried out his ambitious project and the results of his studies have been made accessible by a pleasing logical scheme of classification and arrangement. It is only by some well-systematized procedure that all these gear-cutting machines can be compared or their descriptions made readable.

Machines to cut all sorts and sizes of gears are brought under three classifications. The first grouping is according to the product of the machine; all gears are assembled under four heads—spur, spiral, bevel and worm. Internal gears and racks are classed as spurs. Twisted gears are listed as spirals.

The second grouping is by the way of shaping the gear tooth. There are five general kinds of machines: (1) with a formed cutting tool having the shape of the space between two gear teeth; (2) with a templet and guide that cause the tool to travel in a proper path to cut the desired tooth outline; (3) with means of guiding the tool point along some circular arc that closely approximate the tooth outline; (4) with means of rolling the gear blank, while cutting it, so that the tool point describes an involute, with respect to the positions of the blank; (5) those machines causing a perfectly shaped gear to mesh into and mold a blank.

The third way of grouping these gear-cutting machines relates to the nature of the tooth-cutting operation. Four general methods are disclosed: (1) impression; (2) planing; (3) milling; (4) grinding.

In the main text of this book, following the author's elucidation of this scheme of study and classification, the machines of some 80 odd makers are described with particular respect to their bearing in each of the foregoing classes.

STANDARD HOSE COUPLINGS AND HYDRANT FITTINGS FOR PUBLIC FIRE SERVICE.—Report of Special Committee of National Fire Protection Association. (F. M. Griswold, Chairman, 56 Cedar St., New York City.) Paper; 10¾ × 8½ ins.; pp. 10.

The committee named above has taken great pains to secure and present lists of the cities of the United States using fire hose couplings of various classifications. The classifications are based upon the number of threads to the inch

and the outside and inside diameters. The committee states that it

is very desirous of placing one or more of these tabulated records in the hands of each fire chief, waterworks superintendent or other authority having control of public fire hydrants and fire hose, in order that the recipients may check it up and note such changes as may be necessary to insure accuracy, either by correcting the statements presented, or by adding to the record the name of any town or city not now included, and indicating the dimensions of their couplings as to number of threads and outside diameter of male end, forwarding such data to any member of this committee, or to the secretary of the firemen's or water-works association with which the chief or water-works representative may be affiliated, it being hoped by this method to secure a complete and reliable record for the files of each organization interested in this very important matter.

THE PRACTICAL MANAGEMENT OF SEWAGE DISPOSAL WORKS.—A Handbook for Those in Charge. By W. C. Easdale, M. S. E., M. R. San. I. London, England: The Sanitary Publishing Co., Ltd. Cloth; 4¼ × 6¾ ins.; pp. 54. 2s.; American price, 80 cts.

The brief notes here presented contain a number of useful suggestions designed more particularly for superintendents or managers of small sewage disposal works. Some of the suggestions might well be heeded by superintendents of works large or small, but the amount of information presented seems better suited for a six-penny pamphlet than a two-shilling cloth-bound book.

A GRAPHIC SOLUTION OF KUTTER'S FORMULA.—By L. I. Hewes and Joseph W. Roe, New Haven, Conn. Transactions of the American Institute of Mining Engineers, 29 West 39th St., New York City. Paper; pp. 2; folding diagram.

The paper here reprinted was read at the New Haven Meeting of the American Institute of Mining Engineers in February, 1909. The diagram accompanying the paper is described as follows:

The chart consists essentially of three parallel scales, one for the mean velocity, V, one for the hydraulic radius, R, and one for the slope; a diagonal line, not graduated; and a set of curves for the various values of n, the factor which involves the nature and condition of the bottom.

The authors say in conclusion:

Other graphic solutions of this formula have been worked out, but they nearly all involve a set of diagrams, one for each value of n. So far as we know, there have been none where the entire range of all factors has been included as conveniently in one diagram.

DIE FOERDERUNG VON BASSENGUETERN.—By Georg von Hanffstengel, Leipzig, Privatdozent in the Royal Technical College at Berlin. Vol. II.: Förderer für Einzellasten. Berlin, Germany. Julius Springer. Paper; 6⅛ × 9¼ ins.; pp. 267; 445 illustrations in the text. 16 marks; American price, 75 cts.

This second volume of a work on Bulk Freight Transportation and Handling deals with appliances which handle single loads, as distinguished from continuous machines such as bucket and belt conveyors. The treatment is essentially descriptive, but is characterized by a consistent effort to group and classify the various devices on the basis of their operative elements. The grouping seems curiously artificial or unnatural in many instances, at least for American conditions of practice. Cableways, for example, are treated (very briefly) under cranes, while cable tramways of all kinds are grouped under the head of monorail tramways, where indeed they occupy most of the space, to the disadvantage of trolley transporters.

The subject-matter of the volume embraces, in order, the following groups: Cars for bulk freight, including drop-bottom and other dumping cars; Car dumpers; Two-rail tramways, locomotive, gravity and cable; Single-rail tramways; Elevators (15 pp.); Hoist buckets; Rope and machinery arrangement of cranes; Structural disposition of cranes.

Many excellent drawings and sketches illustrate the machinery described. The book furnishes an excellent condensed descriptive survey of its field. The limitation to bulk materials must be borne in mind, however, as well as numerous points of unbalance attributable to the author's aim at analytical classification.

POCKET MANUAL OF THE ENGINEER'S SOLAR TRANSIT.—New York and Hoboken: Keuffel & Esser Co. Paper; 4¼ × 6⅛ ins.; pp. 52; nine illustrations in the text. 25 cts.

This convenient little pamphlet describes the solar transit made by the firm issuing it, and contains a table of mean refractions, rules for taking the sun at any latitude or longitude, correction of azimuth errors, determining the true meridian, and use of the solar attachment.

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Ore Dressing and Coal Washing.

Reviewed by W. G. HALDANE.*

THE DRESSING OF MINERALS.—By Henry Louis, M. Inst. C. E., M. Inst. M. E., M. Am. Inst. M. E., etc., Professor of Mining and William Cochrane Lecturer on Metallurgy at Armstrong College in the University of Durham, Author of "A Handbook of Gold-Milling," etc. New York: Longmans, Green & Co. London, England: Edward Arnold. Cloth; 6¾ x 10 ins.; pp. 544; 416 illustrations, partly in the text. $5.50, net.

An excellent treatise on this very important subject, and on which the literature is so meagre. The work should commend itself as a reference both to the student and the practical worker in ore dressing and coal washing.

The author states in the foreword that he has broken away from the established and time-honored custom of treating the dressing of ores and the washing of coal as independent subjects, inasmuch as the underlying principles involved in each are identical, and that each is capable of throwing light on the other; yet, notwithstanding this fact, it would seem desirable, after the general theoretical considerations are discussed, to treat these subjects separately. This is particularly true in the United States, where the two industries are so separated from each other. However, the cleverness and tact displayed by the author, in the arrangement of the work, obviates this objection to some degree.

The excellence of the illustrations, which number over 400, and the clear and concise manner in which the work is presented, impresses the reader, and indicates the author's perfect familiarity with his subject.

Some ten pages are devoted to a discussion of the general considerations involved in the dressing of minerals, based on their various properties, mechanical, physical and chemical. Following this, 65 pages are given to a discussion of the theory of volumetric sizing, the design and construction of various forms of screens, and comparisons made; a number of the more common makes are illustrated and accompanied by data as to capacities, initial and maintenance costs under given conditions.

The generally neglected but important subject of sorting and washing occupies about 30 pages. A description is given of the common apparatus used for this purpose, and impresses upon the reader the value of this step in many operations.

The preparation of mineral, preliminary to more extensive dressing, is considered at some length, and the principles underlying comminution by various methods forms an interesting chapter. Here the various types of crushing and fine grinding machinery are fully discussed and illustrated, the theoretical considerations involved in their design taken up fully and the relative advantages of typical forms brought out. Much valuable information concerning costs and construction of jaw breakers, rolls, stamps, tube and ball mills also accompanies the description of these various appliances.

Under separation by specific gravity the author enters into a discussion of free-settling rates and the action of shallow water currents on particles, and after a classification of wet-dressing processes, these are taken up in detail. Under the subject of classification, the action of the spitzkasten and spitzlutte is described and modifications illustrated.

Considerable attention is paid to jigging, from its earliest inception to its modern development, after which separation by a horizontal current, beginning with trough washers and leading up to canvas tables and revolving sluice tables or "buddies," is discussed, probably too prominently, at least as far as the last-named device is concerned. In the western United States the revolving slimer has been gradually withdrawn from service, being replaced by more efficient types of slime-handling apparatus.

The different forms of shaking tables are then considered, with illustrations and general data concerning construction and operation of the more successful and common forms.

Pneumatic separation is given some space, principally in comparison with hydraulic methods, several machines being described to demonstrate the principles involved. Despite the fact that a vast amount of work has been done and numerous patents taken out on air-separating machines, the scheme has met with little success, although certain fields, as for example, the dry placer field, offer attractive inducements for an efficient separator.

The increasing importance of magnetic separation, particularly in the separation of complex zinc, lead and iron sulphide ores, is recognized by the author, and considerable space is given to this subject and typical machines discussed. Electrostatic machines and flotation processes also receive some attention. About 28 pages of the book are given over to accessory apparatus, such as tipplers, conveyors, elevators and mechanical feeders, manifestly too little if this subject is to be treated at all in such a work.

The last chapter, covering some 50 pages, is devoted to a description of typical dressing plants, and covering a wide field of operations.

General, fundamental rules, as far as such rules can be given in such a book, are laid down at this point, covering location, design, power, construction of mill buildings and arrangement of units. This serves to give the reader a comprehensive view of the whole subject, and the many plates accompanying the description are well worthy of study.

In conclusion, it may be said again, that the book offers many valuable suggestions to its readers, and while it is not complete, it is of sufficient scope and sufficient detail to commend itself readily and to merit the attention of any one interested in mineral dressing operations.

*Assistant Professor of Metallurgy and Assaying, Colorado School of Mines, Golden, Colo.

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SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—Proceedings of the Sixteenth Annual Meeting Held in Detroit, Mich., June 24-27, 1908. Vol. XVI. Brooklyn, N. Y.: The Society (Arthur L. Williston, Secy., Pratt Institute). Cloth; 6 x 9 ins.; pp. 414.

An interesting range of papers and discussions on engineering education and various related topics is included in this volume. Altogether the Society has brought out, by its meetings and made available through its publications, a large amount of valuable information bearing upon the great question, How to Educate Engineers. No excuse is presented for delaying the publication of the Proceedings for 1908 until after the convention for 1909 had been held.

THE INCREASE IN THE NATIONAL CONSUMPTION OF WATER.—By William Ralph Baldwin-Wiseman, M. Sc., Assoc. M. Inst. C. E. (165 Shirley Road, Southampton, England). Reprinted from the Journal of the Royal Statistical Society, Vol. LXXII., Part II., June 30, 1909. (Printed for private circulation). Paper; 5⅛ x 8⅛ ins.; pp. 57.

The author has here brought together a considerable amount of information in the way of text and statistics regarding the consumption of water in Great Britain from early until recent times. Early public water-supplies, from the 13th century on, are briefly described. Population and its growth are next considered, after which water consumption by purposes and totals is taken up. Among the tables is one giving populations in thousands for 24 towns at various times from 1085 to 1908; area within the municipal limits and water-supply districts at various times, and the water-supply, and also its representative increase, for various towns at different times. Some of the figures for water consumption range through more than a century.

The author draws no particular conclusions from his studies further than the desirability of forming a central water-conservation authority, which would supervise water-supplies and collect and publish water-supply statistics.

THE SANITARY SIGNIFICANCE OF BACTERIA IN THE AIR OF DRAINS AND SEWERS.—By C.-E. A. Winslow, Biologist in Charge of the Sanitary Research Laboratory and Sewage Experiment Station of The Massachusetts Institute of Technology. Report Made to the Sanitary Committee of the National Association of Master Plumbers of the United States, and Reprinted from the Report of the Sanitary Committee for 1907-1908-1909. Paper; 6 x 9 ins.; pp. 39 to 85; six illustrations, partly in the text, and ten tables.

Ten years ago it was thought that the question of dangers from bacteria in the air of sewers had been practically settled in the negative, but about two years since the question was revived. Prof. Winslow reviews in this pamphlet the history and literature of the subject, and sets forth in detail his own important contributions of experimental evidence. His own summary of the pamphlet noted above, together with his conclusions based on the experiments of others than himself, were reprinted in our issue of Sept. 2, 1909.

AN INTRODUCTION TO CITY PLANNING.—Democracy's Challenge to the American City. By Benjamin Clarke Marsh, Executive Secretary of the Committee on Congestion of Population in New York. With a Chapter on the Technical Phases of City Planning, by George B. Ford, Architect. New York: The Author (Room 1320, 165 Broadway). Paper; 6 x 9¼ ins.; pp. 156; numerous text illustrations.

City planning is here considered primarily from the standpoint of prevention of congestion of population, but the broader aspects of the subject are also taken up. The author first deals with congestion, and then sets forth some of the essentials of city planning. Next, he reprints a brief section from Dr. J. Stübben's "Der Stadtebau," a standard German work on city planning. After this, various examples of city planning are given, a section on the technical phases of city planning, by Mr. George B. Ford, is presented, and some observations on securing a city plan are recorded. Appendixes deal with objections to city planning and give further notes on how to secure a city plan. Finally, there is a brief bibliography.

Considered as notes designed to outline or introduce the subject of city planning, the pamphlet deserves commendation. It might well be studied by city engineers and other municipal officials, as well as by the large and increasing class of citizens who are devoting themselves to the amelioration of city conditions.

Lead and Zinc Pigments.

Reviewed by A. H. SABIN,* Assoc. M. Am. Soc. C. E.

THE LEAD AND ZINC PIGMENTS.—By Clifford Dyer Morse, M. S., Ph. D., Chief Chemist Acme White Lead and Color Works. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¼ x 8¼ ins.; pp. 340; 82 illustrations. $3; English price, 12s. 6d., net.

This is by far the most complete and authoritative book yet written on the subject; the importance of which may perhaps be suggested by the fact that in a ten-year period enough paint is made in this country to put a coat of it over 1% of the entire land and water surface of the United States; and the most important of its pigments contain lead and zinc.

Dr. Holley is the chemist of an important white-lead plant; before undertaking this work he was for some years engaged in experimental and analytical paint investigations, being concerned in the establishment of legal standards for paint, similar to the Pure Food Laws.

It is interesting to note that up to four years ago there was no legislation of any account to protect the paint consumer; when the state of North Dakota enacted a rather stringent law requiring more accurate descriptive labels on paint packages, which was first attacked by the makers of mixed paints, but afterwards received their support as they found it worked hardship only to the less meritorious manufacturers, and tended to the establishment of public confidence, with a corresponding increase of demand. Such laws have now been made in many states.

White lead is made by four processes: The Old Dutch process, the Carter, the Matheson and the Rowley or Mild process. The first is by all odds the most important, and its history, development and present practice, both in this country and abroad, are very fully given. The outline of this method, which is corrosion of plates of cast metal by acetic acid and its further conversion by carbonic acid, in jars set in beds of tan-bark, is well known; but like most simple processes the difficulties encountered are numerous and complex. It takes about four months to make white lead by this method, so it is natural that inventors should have tried to devise rapid processes for getting the same result; but almost all such attempts have been failures.

The first successful one was the Carter process, based on the McCreary and Adams patents, but improved and made commercially successful by Mr. Levi Carter of Omaha. In the melted lead is granulated by a steam jet, and is converted into acetate by using more acid than in the old process, the action taking place in revolving drums, through which is blown a current of carbonic acid from burning coke, the gas having been properly purified. The operation is completed in twelve days.

In the Matheson process the melted metallic lead is poured into cold water, to "feather" it; after which it is put in open tubs or tanks containing dilute acetic acid, which dissolves it, forming acetate of lead; this is further converted into basic lead acetate by injecting air and steam into the solution. Carbonic acid gas, from burning coke, purified by scrubbing, is then led into the solution and basic lead carbonate is precipitated. An advantage of this process is that it is at all times open to inspection; the results are good; the pigment thus produced requires more oil than Dutch lead, to make a paint.

In the Rowley or Mild process the lead is made into an extremely fine powder by spraying it with jets of superheated steam, the steam being above the melting temperature of the lead. This fine metallic lead is cooled in water, and the resulting pulp can be pumped; it is put into large revolving wooden drums and air is blown through it, until it is converted into lead oxide; gas from burning coke, purified from sulphur and the like, is blown through the wet oxide, which is still in the drums, until a basic carbonate is produced. The whole work is done at a low temperature, with no use of acid, and little manual labor, hence the method is economical and sanitary.

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ides are described; lead-poisoning is fully discussed; European practice has a chapter; white zinc and the various ways to make it, and lithopone, are given about fifty pages; and finally about eighty pages are devoted to grinding, painting tests, and physical and chemical examination of both pigments and mixed paints. This analytical part of the book is naturally based on methods brought out in enforcing the laws on the subject, and is very complete and modern.

Scattered through the book everywhere are found remarks on technical and disputed points of much interest, which can not fail to hold the attention of any reader who knows anything of the subject. Dr. Holley believes that a great deal of paint is injured in grinding, letting the mills heat and thus bringing about chemical changes in the materials used. It is noticeable, however, that he does not go into the discussion, now going on vigorously among paint men, about the relative merits of uniformity or heterogeneity of size of pigment-particles; perhaps because this is yet an open question.

Not the least attraction of the book is its illustrations, eight-five in number, very interesting and many of them highly instructive. No other such collection of pictures on this subject is known to the reviewer; to many readers all will be new, and to all readers some will be new.

This book is clearly and well written, well printed, well bound, has a good index, and is very satisfactory.

STRENGTH OF MATERIAL.—An Elementary Study prepared for the Use of Midshipmen at The U. S. Naval Academy. Second Edition, Revised. By H. E. Smith, Professor of Mathematics, U. S. Navy. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5 × 7½ ins.; pp. 170; 73 illustrations in the text. $1.25, net.

Careful inspection of this text does not reveal good reasons for its existence; for, while it is very brief in proportion to its scope, the brevity is gained at the expense of fullness, clearness and accuracy of statement. The arrangement, method of treatment, etc., contain nothing new (except it be the minor point of discussing torsion before taking up bending). The book, therefore, has no claim of advantage over other works on the subject, and various obscurities and other detail defects nullify its advantage of brevity, at least outside the classroom. For school instruction, no doubt, the book can be the basal test just as well as any other book, though its lack of fullness argues against it in this respect. The subtitle, "An Elementary Study," is inappropriate; we fail to find that the author makes the hard points of the subject any easier, and some of them he has even made harder by beclouding them with inadequate or misleading statement.

A CENTURY OF POPULATION GROWTH.—From the First Census of the United States to the Twelfth, 1790-1900. Bureau of the Census. S. N. D. North, Director. Washington, D. C.: Pub. Doc. Cloth; 9 × 11¼ ins.; pp. 303; maps, diagrams, and 115 tables.

It appears that considerable valuable material included in the first census of the United States has never been made available before the publication of this volume. During the past few years, that and related material has been taken in hand by Mr. W. S. Rossiter, Chief Clerk of the Bureau of the Census. The result is this large and interesting volume.

Information from state censuses made prior to the census of 1790 is included and commented on. After this, the populations reported by the first census are given by counties and minor civil divisions, and subsequently the white and negro population, the sex and age of the white population, analysis of the family, surnames of the white population in 1790, nationality of heads of families, and interstate migration, were considered. Alongside of many of the statistics for 1790, corresponding ones for 1900 are given, and in a few instances figures for some of the intervening years are presented.

The volume contains a number of reproductions of interesting old maps, some of cities, some of states, and some of larger sections.

A Book and a Challenge

The book is CONCRETE, by Edward Godfrey. This is a book of 414 pages of useful information on concrete and reinforced concrete. The challenge is the book. The book does not follow the lines of the general run of books on this subject and take a large part of its matter from catalogs of owners of patented systems. Patented fads are totally ignored. An American book on reinforced concrete that makes no mention whatever of any of the well-advertised systems and patented bars is an anomaly. Furthermore, the fallacy of some of the essential features of some of these systems is demonstrated, and no voice is raised up in defense.

This author has publicly contradicted some of the best known authorities in the world. Because of the publicity these authorities can scarcely be ignorant of the facts. Yet they have made no defense and no reply. Silent contempt cannot explain it, for these same authorities and others are revising their practice and works and teaching.

In 1906 this author published three articles in ENGINEERING NEWS on reinforced concrete design. These brought out so much criticism and discussion that the editor, after filling 36 columns, had to refuse to print any more, unless something new or useful should be brought out. In 1907 he published a series of articles in CONCRETE ENGINEERING. These also brought out much criticism. Three of them were very fully quoted in that excellent periodical the ENGINEERING DIGEST. In these articles much common practice was criticised. All of these articles and a great deal more are found in this book, CONCRETE.

The book contains the simplest treatment of arches and of reinforced-concrete chimneys in existence. It contains the ONLY FULLY RATIONAL AND APPLICABLE treatment of reinforced-concrete slabs supported on four edges.

The book is a challenge to the engineering world and to authorities everywhere. Many of its statements are exactly contrary to those of many other books, and the facts and reasons are plainly and emphatically given.

Before this author's papers were published in 1906 it was "common practice" to reinforce concrete footings with a mat of reinforcing rods equally spaced both ways. Now it is rare to find any footing designed that way.

No book on dams mentions the fact that dams should be proportioned for water pressure in horizontal seams. One large college has revised lecture notes to include this neglected principle, BECAUSE OF THIS AUTHOR'S AGITATION. AN OFFICIAL EXPERT REPORT last year gave this pressure as the cause of failure of a large dam.

In 1907 a pamphlet was published on shearing tests of concrete that purported to show that concrete is nearly as strong in shear as in compression. This author promptly published an article pointing out that these tests were misleading because of the compression on specimens showing high shear. The JOINT COMMITTEE REPORT has issued what amounts to a warning against high units in shear where the concrete is not in compression. This is new to the literature of this subject, excepting this author's writings.

This author has many times shown up the absurdity of stirrups. Nearly every other book on the subject gives stirrups as a standard and correct method of design. The JOINT COMMITTEE REPORT tells how to find the stress in a stirrup. This author recently criticised much of that report very severely. Stirrups will in a few years be an obsolete and condemned method of design.

Alleged reinforcement of concrete columns with slender rods is a common and dangerous practice, and it has several very bad wrecks to its credit. This author has repeatedly maintained its error and has pointed out where tests prove him to be right. Other authors add enormous fictitious compression values to columns containing these rods. This sort of reinforcement will also be among the obsolete and condemned when engineers wake up. Sharp bends in rods will go with it.

A late book devotes much space to a solution of the rectangular slab problem, given by one of England's highest authorities. This author in a published letter last year showed that solution to be totally wrong. The price of CONCRETE is $2.50. Address

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AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—Proceedings, 1909. Chicago, Ill.: The Association (E. H. Fritch, Secretary, 962 Monadnock Block). In two volumes. Paper; 6 × 9 ins.; pp. 1,657; illustrated. $5. (Cloth, $6; half morocco, $7.)

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—Journal, June 1, 1909, Vol. I. (Containing Constitution and List of Members.) New York: The Society (Daniel J. Hauer, Secretary, Park Row Building). Paper; 5¾ × 8¾ ins.; pp. 64; two-page supplement.

BUILDING PLANS AND HOW TO DRAW THEM.—A Simple Series of Practical Lessons on Architectural Drawing, Showing Every Step Necessary to Draw the Full Working Plans of Buildings. Intended for the Self-Instruction of Building Mechanics. By I.

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THE BULLETIN.—Official Organ of the Technical League. Vol. I., No. 1, Aug. 1, 1909. New York: The League (Park Row Building). Paper; 6 x 9¼ ins.; pp. 8. 25 cts.; single copies, 5 cts.

BULLETINS, OFFICIAL STATISTICS, COMMONWEALTH OF AUSTRALIA.—Published under the authority of the Minister of Home Affairs by G. H. Knibbs, F. R. S. S., Commonwealth Statistician. Melbourne, Australia: Pub. Doc. Paper; 8¼ x 13 ins.

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BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ x 9¼ ins.

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A DICTIONARY OF TERMS USED IN ARCHITECTURE AND BUILDING.—Compiled from the Best Authorities. New York: Industrial Publication Co. Cloth; 4¾ x 7½ ins.; pp. 104; numerous illustrations in the text. 50 cts.

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ELECTRICAL COMMISSION OF BALTIMORE.—Report of the Chief Engineer (Charles E. Phelps). Baltimore, Md.: Pub. Doc. Report for the Years 1898-1905: Cloth; 6 x 9½ ins.; pp. 213; numerous folding plates. Report for the Years 1906-1907-1908: Paper; 6 x 9 ins.; pp. 8; folding tables.

THE ENGINEER AND THE COMMUNITY.—Address by William McClellan, Ph. D. (at the 10th Annual Commencement, June 17, 1909, Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y.). (Reprinted from Clarkson Bulletin, Vol. VI., No. 3.) Paper; 6 x 9 ins.; pp. 7.

THE ENGINEERING OF ORDNANCE.—By A. Trevor Dawson, Lieut. R. N., M. Inst. C. E., M. Inst. M. E., etc. The Gustav Canet Lecture, delivered at the 25th Anniversary Meeting of the Establishment of the Junior Institution of Engineers, June 30, 1909. (Supplement to Vol. XIX. of the Transactions of the Junior Institution of Engineers.) London, England: Percival Marshall & Co. Paper; 7¼ x 9½ ins.; pp. 53; 68 illustrations, partly in the text. 2s. 6d.; American price, $1.

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GEOLOGIC ATLAS OF THE UNITED STATES.—U. S. Geological Survey, George Otis Smith, Director. No. 167: Trenton Folio, New Jersey-Pennsylvania. By F. Bascom, N. H. Darton, H. B. Kümmel, W. B. Clark, B. L. Miller, and R. D. Salisbury. Washington, D. C.: Pub. Doc. Stiff paper; 18½ x 21¾ ins.; pp. 24; four plates and three text figures.

ILLINOIS FREE EMPLOYMENT OFFICES.—Annual Report of the Bureau of Labor Statistics for the Year Ending Sept. 30, 1908. David Ross, Secretary, Springfield. Springfield, Ill.: Pub. Doc. Paper; 5¾ x 9 ins.; pp. 115.

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THE JOURNAL OF THE IRON AND STEEL INSTITUTE.—Vol. LXXIX., No. 1, 1909. Edited by George C. Lloyd, Secretary. London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½ × 8¾ ins.; pp. 737; folding and other plates, and text illustrations. $6.

MACHINE SHOP DRAWINGS.—Reading Drawings, Making Shop Sketches, Laying Out Work. By Fred H. Colvin, M. Am. Soc. M. E., Associate Editor of "The American Machinist," Author of "Machine Shop Calculations," etc. New York: McGraw-Hill Book Co. Cloth; 4½ × 7 ins.; pp. 139; 91 illustrations in the text. $1, net.

METAL CORROSION AND PROTECTION.—References to Books and Magazine Articles. (Reprinted from the Monthly Bulletin, Carnegie Library of Pittsburg, July, 1909.) Second edition, revised and enlarged. Pittsburg, Pa.: The Library. Paper; 6 × 9 ins.; pp. 64. 10 cts.

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NATURAL SOURCES OF POWER.—By Robert S. Ball, Assoc. M. Inst. C. E. New York: D. Van Nostrand Co. Cloth; 5⅛ × 8⅛ ins.; pp. 348; 104 illustrations, mostly in the text. $2, net.

NOTES ON CERTAIN POINTS IN THE DESIGN OF LARGE FILTRATION PLANTS.—By S. Bent Russell. (Reprinted from Journal of the Association of Engineering Societies, Vol. XLII., No. 6, June, 1909.) Paper; 6 × 9¼ ins.; pp. 323 to 336; three figures in the text.

ORE DRESSING.—By Robert H. Richards, LL. D., Professor of Mining and Metallurgy at the Massachusetts Institute of Technology, Boston, Mass. In four volumes. Vols. III. and IV. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 1199 to 1610 and 1611 to 2052; 300 illustrations in the text. $5, net, each.

PHILADELPHIA.—Published by the City Government. Vol. I., No. 2, August, 1909. Paper; 9¼ × 12¼ ins.; pp. 15; illustrated.

THE PRESENT STATUS OF THE CHESTNUT BARK DISEASE.—By Haven Metcalf, Pathologist in Charge, and J. Franklin Collins, Special Agent, Investigations in Forest Pathology. Bulletin No. 141, Part V., Bureau of Plant Industry; B. T. Galloway, Chief. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.; pp. 45 to 53; one plate and one text figure.

THE PUBLIC HEALTH AGITATION, 1833-48.—By B. L. Hutchins, Joint Author of "A History of Factory Legislation." London, England: A. C. Fifield. Cloth; 5 × 7¾ ins.; pp. 150. 2s. 6d., net; American price, $1.

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REPORT ON THE CHROME IRON ORE DEPOSITS IN THE EASTERN TOWNSHIPS, PROVINCE OF QUEBEC.—By Fritz Cirkel. Mines Branch, Canada Department of Mines; Eugene Haanel, Ph. D., Director. Ottawa, Can.: Pub. Doc. (No. 29). Paper; 6½ × 10 ins.; pp. 141; 12 plates and 14 text figures.

REPORT ON THE INVESTIGATION OF AN ELECTRIC SHAFT FURNACE, DOMNARFVET, SWEDEN, ETC.—By Eugene Haanel, Ph. D., Director of Mines, Canada. Ottawa, Can.; Pub. Doc. Paper; 6½ × 10 ins.; pp. 38; 14 illustrations, partly in the text.

THE ST. LAWRENCE ROUTE.—Its Past and Future. Canada's Natural Waterway from the Rockies to the Sea. Being a Paper read by Thos. Conlon, Esq., Member of the Dominion Marine Association, before Thorold Board of Trade, May 11, 1909. Thorold and St. Catharines, Ont.: Board of Trade. Paper; 5 × 6¾ ins.; pp. 33.

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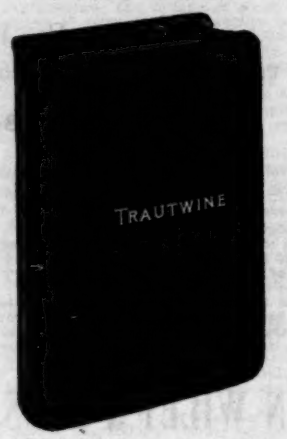

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